Report on the General Avian Inventory of Florissant Fossil Beds National Monument, Colorado

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Abstract

The National Park Service (NPS) developed a Task Agreement with Rocky Mountain Bird Observatory (RMBO) to conduct an avian inventory of Florissant Fossil Beds National Monument (FLFO) in Colorado as part of a new service-wide emphasis on inventory and monitoring. The inventory was a component of a suite of biological inventories being conducted within the Rocky Mountain Network (ROMN). The objectives of the inventories were (1) to document the occurrence of bird species, (2) to describe the distribution and, where possible, the population densities of those species, (3) to identify critical bird habitats, (4) to identify bird species of special management concern, and (5) to recommend a long-term bird monitoring program.

To implement the inventory, field biologists conducted 40 point counts in the two major habitat types of FLFO (Ponderosa Pine and Meadow) and analyzed the data gathered using distance sampling methodology (Buckland et al. 1993, Leukering et al. 2001). Field biologists also surveyed wintering and migratory species by conducting informal bird surveys in FLFO. They used the Global Positioning System (GPS) to document the locations of all bird detections.

Field biologists conducted the point-count transects on 1 June and 12 June, 2005. During the transects, they detected a total (in both habitats combined) of 291 individual birds of 40 species. The only species for which they obtained sample sizes sufficient to calculate density (>11 individuals) were Mourning Dove, Western Wood-Pewee, and Vesper Sparrow (all in Ponderosa Pine habitat).

To inventory wintering, migratory, and nocturnal birds, field biologists conducted a series of informal bird counts in FLFO. During the informal counts, they did not determine distances to birds; the tendency of most wintering and migratory birds to flock makes distance sampling difficult and impractical for this purpose (see Buckland et al. 2001). Field Biologists also communicated with local birders to obtain records of rare species that have occurred in FLFO. Results of the informal surveys are reflected in the FLFO bird checklist (Appendix C).

The following species that were documented during the inventory or were already present on the FLFO bird checklist are listed in the Colorado Partners in Flight (CO-PIF) Bird Conservation Plan as species of special management concern: Broad-tailed Hummingbird, Williamson's Sapsucker, Red-naped Sapsucker, Olive-sided Flycatcher, Hammond's Flycatcher, Cordilleran Flycatcher, Violet-green Swallow, American Dipper, Wilson's Warbler, Green-tailed Towhee, and Brewer's Sparrow. In order to provide NPS with management suggestions, I reviewed the CO-PIF Bird Conservation Plan and provide summaries for these species.

Careful monitoring of bird populations is a vital part of identifying changes that could signal trouble for bird species. An advantage of having used distance sampling for this inventory is that the inventory can evolve into a monitoring program if funding is arranged to conduct transects and point counts in future years. In this report I provide detailed directions that will allow for the point count transects to be repeated in future years.

Introduction

As part of the NPS Natural Resource Challenge (1999), The Rocky Mountain Inventory and Monitoring Network has identified avian inventory needs at several parks and monuments, including Florissant Fossil Beds National Monument (hereafter, FLFO) in east-central Colorado. A review of records by park personnel indicated that an extensive survey of existing avifauna of FLFO had not been completed. Species presence/absence had not been adequately determined for some species in all habitats. Lack of such baseline information may limit the National Park Service's ability to develop adequate management guidelines for avian species and their habitats or to adequately protect those species. As part of a new service-wide emphasis on inventory and monitoring, in 2001 the National Park Service entered into a task agreement (Task Agreement J1242030466) with Rocky Mountain Bird Observatory (RMBO) to conduct an avian inventory of FLFO. The inventory was one component of a suite of biological inventories being conducted within the Rocky Mountain Network (ROMN). The objectives of the inventory were to:

1) Document through existing, verifiable data and field investigations the occurrence of at least 90 percent of the bird species currently estimated to occur in FLFO;
2) Using systematic surveys, document presence/absence of bird species, and their distribution and qualitative abundance in habitats that were historically under-sampled or not sampled;
3) Identify locations of critical breeding and non-breeding habitats where current records are lacking;
4) Document presence/absence of birds of special management concern that are known or expected to occur in FLFO based on habitat or historic records;
5) Based on the inventory, recommend an effective monitoring program so that Resource Management staff at each park can assess the condition of bird populations over time and detect significant changes in those populations; and
6) Summarize bird information in appropriate formats to contribute to the population of National Park Service databases.

RMBO staff began work during the spring of 2005 and completed the project during the winter of 2005. This report presents the results of their efforts.

Methods

The inventory consisted of surveys of breeding (spring and summer), migratory (spring and fall), and wintering birds. To inventory breeding birds, field biologists conducted point-count transects that surveyed the two major habitats of FLFO (Ponderosa Pine and Meadow). Fifteen of the points conducted in ponderosa pine were established as part of the Monitoring Colorado's Birds program and have been conducted since 1999 (Appendix A). I used distance sampling methodology (Buckland et al. 1993, Leukering et al. 2001) to derive estimates of breeding bird densities. Field biologists attempted to place point counts stations proportionately in the available habitats and spaced 250 meters apart. During point counts, field biologists recorded every individual bird heard

or seen during a five-minute period, and used laser rangefinders to determine distances to the birds. For a more detailed description of field protocol, see Appendix F.

Meadow (ME) – I designated open habitat surrounded by forests and dominated by various grass and shrub species as Meadow. Field biologists conducted 10 point counts in this habitat.

Ponderosa Pine (PP) – I designated forested habitat (almost pure ponderosa pine) as Ponderosa Pine. Field biologists conducted 30 point counts in this habitat.

To inventory wintering, migratory, and nocturnal birds, field biologists conducted informal bird surveys throughout the park, attempting to cover the area thoroughly. During the informal counts, observers did not record distances to the birds; the erratic movement of most wintering and migratory birds, and their tendency to flock makes distance sampling impractical (see Buckland et al. 2001).

I used Program DISTANCE to determine density estimates for species with sample sizes >11 individual detections. In this report, all references to density estimates are values provided by DISTANCE, and are denoted as "D." The notation, concepts, and analysis methods of the program were developed by Buckland et al. (1993, 2001). The program can analyze several forms of distance-sampling data, fitting a detection curve to the data set to be analyzed. The program limits some serious biases inherent in traditional analysis of point-count data (e.g., variable detectability among species, habitats, or years), but comes with three assumptions: 1) all birds at distance 0 are detected; 2) distances of birds close to the point are measured accurately; and 3) birds do not move in response to the observer's presence. I should note that I chose a minimum of twelve independent detections for analyses in order to include more species in the final analyses. However, twelve independent detections may not be a sufficient sample size for statistically significant results, as a low sample size typically results in a large confidence interval and coefficient of variation (Buckland et al. 1993). In this report, densities of species with low sample sizes should be treated with caution, and confidence intervals should be studied closely. Also, note that RMBO protocol treats all non-independent detections of individual birds as part of a 'cluster' together with the first independently observed bird, rather than as separate independent observations.. This means that if the detection of a bird or birds is dependent upon the previous detection of another individual, the resulting observation is recorded as one independent detection with a cluster size of *C*, where *C* is the original individual detected plus the sum of any additional individuals whose detection was dependent upon the first individual revealing their presence. For example, a bird sings, and is thus detected independently. The observer then looks over to that bird, and as a result, detects a second individual. The resulting observation is recorded as one detection of a cluster of two birds. This practice ensures that we adhere more strictly to the assumption inherent in random sampling that all observations are independent of each other. It also reduces sample size in some instances, for example, field biologists recorded a total of twelve Violet-green Swallows in Meadow during point-counts, however, these twelve birds represent only 5 independent detections.

To supplement field investigations, I reviewed the FLFO bird checklist to determine which species had been previously documented in the area. I also requested information from Colorado bird watchers through the internet list-serve hosted by the Colorado Field Ornithologists (CoBirds).

Since the bulk of the fieldwork focused on breeding bird species, references in the "Results" section below refer only to breeding bird point counts. Results of winter, migratory, and nocturnal surveys are reflected in the revised FLFO bird checklist (Appendix C).

Results

During the point-count transects, field biologists detected a total (in both habitats combined) of 278 individual birds of 40 species (Table 1). A sample size sufficient to calculate density in an individual habitat (>11 individuals) was obtained for Mourning Dove (PP), Western Wood-Pewee (PP), and Vesper Sparrow (PP)(Table 2). Only two individual raptors, both Red-tailed Hawks, were detected (Table 2). Species of note that were detected in low numbers included Turkey Vulture, Williamson's Sapsucker, Hairy Woodpecker, Black-billed Magpie, Green-tailed Towhee, and Savannah Sparrow (Table 2).

Meadow – Field biologists detected 66 individual birds of 25 species in Meadow habitat (Table 1) but did not obtain sample size sufficient to calculate density estimates for any species (the survey area was much too small to provide sufficient sample size for any species).

Ponderosa Pine – Field biologists detected 212 individual birds of 36 species in Ponderosa Pine habitat (Table 1) and obtained sufficient sample size to calculate density estimates for three species: Mourning Dove (D = 0.039 birds per hectare), Western Wood-Pewee (D = 0.055 birds per hectare), and Vesper Sparrow (D = 0.048 birds per hectare). The survey area was much too small to provide sufficient sample size for any but the most abundant species.

I revised the FLFO bird checklist to include 154 species (Appendix C). In addition to the 85 species that field biologists detected during the inventory, 36 are documented in *Colorado Birds* (Andrews and Righter 1992), and 33 are documented on the current checklist of FLFO birds.

Table 1. Number of point counts in each habitat with totals of species and individuals detected in Florissant Fossil Beds National Monument, Summer 2005.

Habitat	# point counts	# species	# individuals
Meadow	10	25	66
Ponderosa Pine	30	36	212
All	40	40	278

Table 2. Numbers of birds detected on point counts at Florissant Fossil Beds National Monument, Summer 2005.

Species	Ponderosa Pine	Meadow	Total
Turkey Vulture	0	1	1
Red-tailed Hawk	1	1	2
Mourning Dove	13	7	20
Broad-tailed Hummingbird	7	2	9
Williamson's Sapsucker	1	0	1
Hairy Woodpecker	1	0	1
Northern Flicker	8	2	10
Olive-sided Flycatcher	1	1	2
Western Wood-Pewee	18	4	22
Steller's Jay	7	1	8
Clark's Nutcracker	2	0	2
Black-billed Magpie	0	1	1
American Crow	5	0	5
Common Raven	3	0	3
Violet-green Swallow	6	12	18
Cliff Swallow	0	2	2
Mountain Chickadee	11	0	11
White-breasted Nuthatch	3	0	3
Pygmy Nuthatch	6	1	7
House Wren	5	2	7
Ruby-crowned Kinglet	10	0	10
Western Bluebird	2	1	3
Mountain Bluebird	1	3	4
Townsend's Solitaire	5	1	6
Hermit Thrush	6	0	6
American Robin	7	6	13
Yellow-rumped Warbler	3	0	3
Western Tanager	3	0	3
Green-tailed Towhee	0	1	1
Chipping Sparrow	4	1	5
Vesper Sparrow	15	3	18
Savannah Sparrow	1	0	1
Song Sparrow	1	1	2
Lincoln's Sparrow	2	0	2
Dark-eyed Junco	10	0	10
Red-winged Blackbird	1	4	5
Western Meadowlark	5	2	7
Brewer's Blackbird	9	4	13
Brown-headed Cowbird	5	2	7
Pine Siskin	24	0	24

Table 3. Results of DISTANCE analysis for species with sample sizes >11 in individual habitats at Florissant Fossil Beds National Monument. n=untruncated sample size; D=density estimate, expressed as individuals per hectare (from program DISTANCE); CI=95% confidence intervals of density estimate; CV(%)=percent coefficient of variation of the density estimate.

Species	Habitat	n	D	CI	CV
Mourning Dove	PP	13	0.039	0.015-0.100	45.5%
Western Wood-Pewee	PP	18	0.055	0.025-0.120	37.8%
Vesper Sparrow	PP	15	0.048	0.022-0.106	38.1%

Table 4. Results of DISTANCE analysis for all species combined among both habitats in Florissant Fossil Beds National Monument. n=sample size; D=density estimate, individuals per hectare (from program DISTANCE); CI=95% confidence intervals of density estimate; CV(%)=percent coefficient of variation of the density estimate.

Habitat	n	D	CI	CV(%)
Meadow	59	3.733	1.991-7.000	32.2%
Ponderosa Pine	197	12.709	3.014-53.585	83.8%

Discussion

Documentation of 90 percent of the bird species currently expected to occur in FLFO

Of the 154 species on the revised checklist of Florissant Fossil Beds National Monument birds (Appendix C), 118 species are listed as "Present in Park" and 36 are listed as "Probably Present". Species listed as "Present in Park" account for 77% of the total list.

Because of the unpredictable behavior of migratory birds, their presence in any area can be erratic. Many migratory species expected to occur in FLFO (listed as "Probably Present" on the FLFO bird checklist) were included based on their occurrences in neighboring areas or based on their habitat preferences as documented in *Colorado Birds* (Andrews and Righter 1992). Occurrences of these species in FLFO are hypothetical and do not indicate that the species will actually occur. Documentation of migratory species is an ongoing process, and it may take many years to confirm some of these species. Some of them may never be confirmed, and some species that have occurred in the park historically may never occur there again (a small number of individuals of many species wander far from their normal migratory ranges). The confirmation of these species will, therefore, be dependent upon park personnel and visitors submitting Natural History Field Observation Cards. I recommend that FLFO personnel familiarize themselves with the checklist and submit cards for sightings of species listed as "Probably Present". I also recommend posting a list of these species at interpretive sites with an explanation of the importance of documenting the species. Many skilled birders visit FLFO, and they are valuable assets. Photographs of the birds should accompany field observation cards when possible; however, since photographing birds is often difficult, all cards should include at least detailed descriptions of the birds' identification marks, behaviors, and anything else that may aid in their identification.

Documentation of the distribution and abundance of the bird species

The table of detection locations in conjunction with the map in Appendix C provides visual representations of the distribution of detections within FLFO of species listed by Colorado Partners In Flight as being "priorities for conservation needs". The table lists only those species detected during the point-count transects This information should not be interpreted as the overall distribution of the species in FLFO, as many species are sure to occur in areas that field biologists did not survey, or were present but not detected in areas that they did survey.

Identification of locations of critical breeding and non-breeding bird habitats

In FLFO, Ponderosa Pine habitat had the higher overall bird density (D = 12.709 birds per hectare) of the two habitats (Table 4). Bird density was lower in Meadow habitat (D = 3.733) (Table 4). Note that one year's data is not sufficient to draw any conclusions about these results.

Documentation of the presence/absence of birds of special management concern

The Colorado Partners in Flight (CO-PIF) Bird Conservation Plan (Colorado Partners in Flight 2000) lists the following eleven species, which were detected at FLFO during our surveys, as "High Priority" for conservation needs in Colorado: Broad-tailed Hummingbird, Williamson's Sapsucker, Red-naped Sapsucker, Olive-sided Flycatcher, Hammond's Flycatcher, Cordilleran Flycatcher, Violet-green Swallow, American Dipper, Wilson's Warbler, Green-tailed Towhee, and Brewer's Sparrow. In order to provide NPS with management suggestions, I reviewed the CO-PIF Bird Conservation Plan and provide summaries for these species (Appendix D).

Recommendation of an effective monitoring program – Careful monitoring of bird populations is a vital part of identifying changes that could signal trouble for species. Although several monitoring methods are available, distance sampling has been used for more than 30 years to estimate population densities of animals and is, in most situations, considered the best method for determining relative population densities or trends for most bird species (Buckland et al. 1993, Fancy and Sauer 2000). For a detailed history and description of distance sampling and its use in the National Parks, see Fancy and Sauer (2000). An advantage of having used distance sampling for this inventory is that the inventory can evolve into a monitoring program if funding to conduct transects and point counts is arranged in future years. Appendix A provides locations that will allow for point counts to be repeated in future years.

Summarization of bird information in the National Park Service databases – All of the data (raw and electronic) collected during this inventory are on file at the National Park Service, Rocky Mountain Network, and are available from: Data Manager, National Park Service, 1201 Oak Ridge Dr., Suite 200, Fort Collins, CO 80525. Data are also available on the NPSpecies website at HTTP://science.nature.nps.gov/im/apps/npspp/index.htm.

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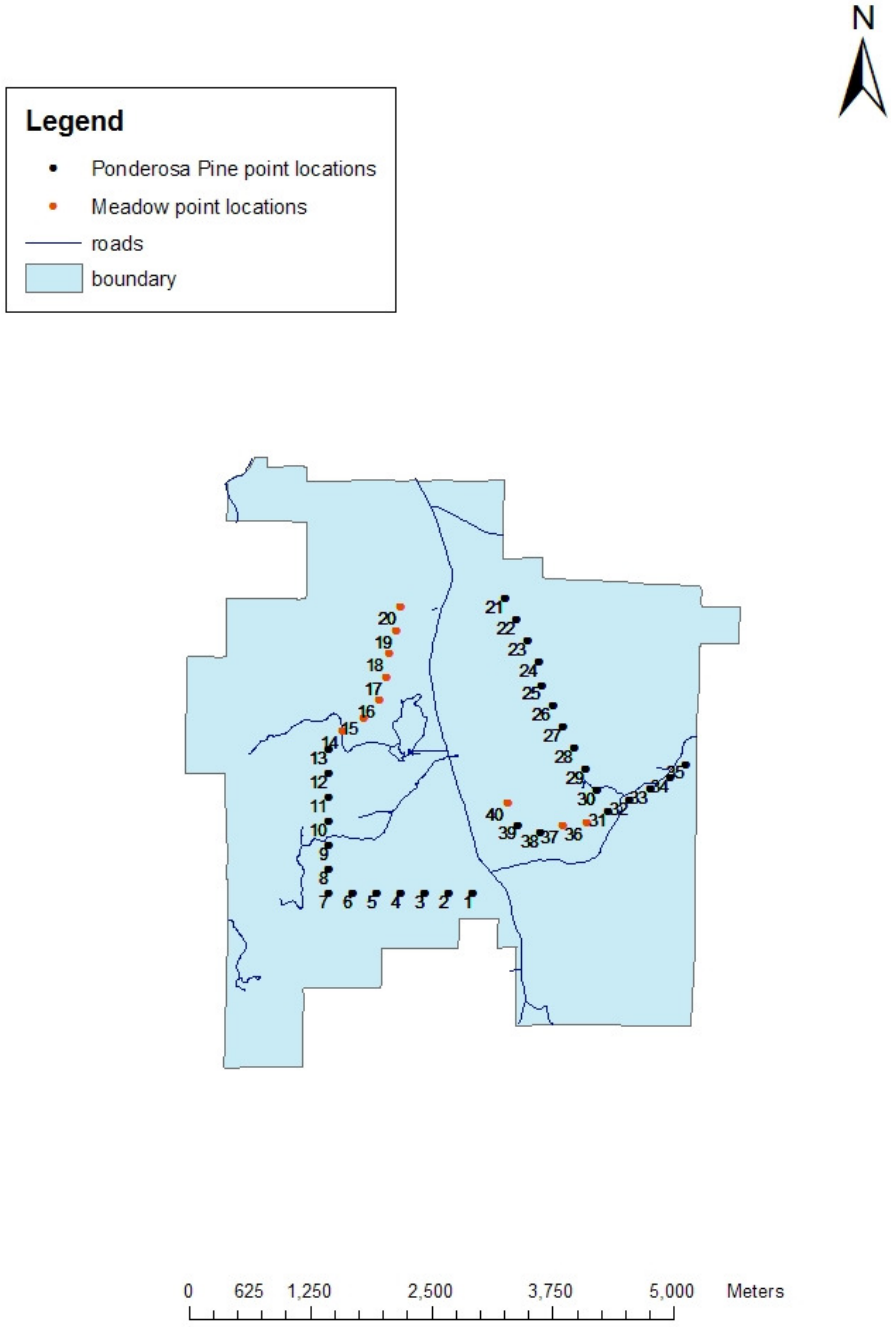
Appendix A. Point count distribution and their UTM locations in Florissant Fossil Beds National Monument, 2005.



Point number	Zone	Easting	Northing	Habitat
1	13S	475936	4305761	Ponderosa Pine
2	13S	475690	4305761	Ponderosa Pine
3	13S	475443	4305761	Ponderosa Pine
4	13S	475196	4305761	Ponderosa Pine
5	13S	474949	4305761	Ponderosa Pine
6	13S	474705	4305763	Ponderosa Pine
7	13S	474457	4305762	Ponderosa Pine
8	13S	474457	4306015	Ponderosa Pine
9	13S	474457	4306260	Ponderosa Pine
10	13S	474457	4306505	Ponderosa Pine
11	13S	474452	4306752	Ponderosa Pine
12	13S	474458	4306998	Ponderosa Pine
13	13S	474456	4307246	Ponderosa Pine
14	13S	474603	4307444	Meadow
15	13S	474811	4307579	Meadow
16	13S	474974	4307764	Meadow
17	13S	475046	4308000	Meadow
18	13S	475073	4308244	Meadow
19	13S	475151	4308477	Meadow
20	13S	475194	4308720	Meadow
21	13S	476279	4308804	Ponderosa Pine
22	13S	476391	4308589	Ponderosa Pine
23	13S	476505	4308376	Ponderosa Pine
24	13S	476620	4308158	Ponderosa Pine
25	13S	476652	4307914	Ponderosa Pine
26	13S	476765	4307698	Ponderosa Pine
27	13S	476878	4307482	Ponderosa Pine
28	13S	476992	4307264	Ponderosa Pine
29	13S	477107	4307047	Ponderosa Pine
30	13S	477224	4306827	Ponderosa Pine
31	13S	477337	4306609	Ponderosa Pine
32	13S	477554	4306725	Ponderosa Pine
33	13S	477770	4306839	Ponderosa Pine
34	13S	477986	4306955	Ponderosa Pine
35	13S	478136	4307098	Ponderosa Pine
36	13S	477117	4306497	Meadow
37	13S	476873	4306468	Meadow
38	13S	476642	4306389	Ponderosa Pine
39	13S	476411	4306471	Ponderosa Pine
40	13S	476310	4306694	Meadow

*Point numbers in bold are transect CO-PP22 which has been conducted since 1999.

Appendix B. Point-count stations where Colorado Partners in Flight "Priority Species" were detected in Florissant Fossil Beds National Monument, 2005.

Species	Point-count Station Number
Broad-tailed Hummingbird	5, 7, 20, 21, 33, 34, 35, 40
Williamson's Sapsucker	13, 33
Olive-sided Flycatcher	22, 40
Violet-green Swallow	6, 13, 16, 19, 20, 36, 39, 40
Green-tailed Towhee	20

Appendix C. Revised Florissant Fossil Beds National Monument bird checklist.

Common Name	Scientific Name	Park Status	Abundance	Residency
Canada Goose	*Branta canadensis*	Present	Common	Breeder
Gadwall	*Anas strepera*	Present	Uncommon	Migratory
American Wigeon	*Anas americana*	Present	Uncommon	Migratory
Mallard	*Anas platyrhynchos*	Present	Common	Breeder
Blue-winged Teal	*Anas discors*	Present	Uncommon	Migratory
Cinnamon Teal	*Anas cyanoptera*	Present	Uncommon	Migratory
Northern Shoveler	*Anas clypeata*	Probably Present	Uncommon	Migratory
Northern Pintail	*Anas acuta*	Probably Present	Uncommon	Migratory
Green-winged Teal	*Anas crecca*	Present	Uncommon	Migratory
Redhead	*Aythya americana*	Probably Present	Uncommon	Migratory
Ring-necked Duck	*Aythya collaris*	Probably Present	Uncommon	Migratory
Lesser Scaup	*Aythya affinis*	Probably Present	Uncommon	Migratory
Bufflehead	*Bucephala albeola*	Present	Uncommon	Migratory
Common Goldeneye	*Bucephala clangula*	Probably Present	Uncommon	Migratory
Common Merganser	*Mergus merganser*	Present	Uncommon	Migratory
Ruddy Duck	*Oxyura jamaicensis*	Probably Present	Uncommon	Migratory
Blue Grouse	*Dendragapus obscurus*	Probably Present	Uncommon	Breeder
Wild Turkey	*Meleagris gallopavo*	Present	Uncommon	Breeder
Pied-billed Grebe	*Podilymbus podiceps*	Probably Present	Uncommon	Migratory
Great Blue Heron	*Ardea herodias*	Present	Uncommon	Migratory
Turkey Vulture	*Cathartes aura*	Present	Common	Breeder
Osprey	*Pandion haliaetus*	Probably Present	Uncommon	Migratory
Northern Harrier	*Circus cyaneus*	Present	Uncommon	Migratory
Sharp-shinned Hawk	*Accipiter striatus*	Present	Uncommon	Breeder
Cooper's Hawk	*Accipiter cooperii*	Present	Uncommon	Breeder
Northern Goshawk	*Accipiter gentilis*	Probably Present	Rare	N
Swainson's Hawk	*Buteo swainsoni*	Present	Rare	Migratory
Red-tailed Hawk	*Buteo jamaicensis*	Present	Common	Breeder
Ferruginous Hawk	*Buteo regalis*	Present	Rare	Migratory

Common Name	Scientific Name	Park Status	Abundance	Residency
Rough-legged Hawk	*Buteo lagopus*	Present	Rare	Migratory
Golden Eagle	*Aquila chrysaetos*	Present	Uncommon	Breeder
American Kestrel	*Falco sparverius*	Present	Common	Breeder
Merlin	*Falco columbarius*	Probably Present	Rare	Migratory
Peregrine Falcon	*Falco peregrinus*	Probably Present	Rare	Migratory
Prairie Falcon	*Falco mexicanus*	Present	Uncommon	Migratory
American Coot	*Fulica americana*	Probably Present	Uncommon	Migratory
Killdeer	*Charadrius vociferus*	Present	Uncommon	Breeder
Spotted Sandpiper	*Actitis macularia*	Present	Uncommon	Breeder
Wilson's Snipe	*Gallinago delicata*	Present	Uncommon	Breeder
Franklin's Gull	*Larus pipixcan*	Probably Present	Rare	Migratory
Ring-billed Gull	*Larus delawarensis*	Present	Uncommon	Migratory
California Gull	*Larus californicus*	Present	Uncommon	Migratory
Rock Pigeon	*Columba livia*	Probably Present	Uncommon	Breeder
Band-tailed Pigeon	*Patagioenas fasciata*	Probably Present	Uncommon	Breeder
Mourning Dove	*Zenaida macroura*	Present	Common	Breeder
Flammulated Owl	*Otus flammeolus*	Probably Present	Rare	Breeder
Great Horned Owl	*Bubo virginianus*	Present	Uncommon	Breeder
Northern Pygmy-Owl	*Glaucidium gnoma*	Probably Present	Uncommon	Breeder
Long-eared Owl	*Asio otus*	Probably Present	Uncommon	Migratory
Short-eared Owl	*Asio flammeus*	Present	Rare	Migratory
Northern Saw-whet Owl	*Aegolius acadicus*	Present	Uncommon	Breeder
Common Nighthawk	*Chordeiles minor*	Present	Uncommon	Breeder
Common Poorwill	*Phalaenoptilus nuttallii*	Probably Present	Uncommon	Breeder
White-throated Swift	*Aeronautes saxatalis*	Present	Uncommon	Breeder
Calliope Hummingbird	*Stellula calliope*	Probably Present	Uncommon	Migratory
Broad-tailed Hummingbird	*Selasphorus platycercus*	Present	Common	Breeder
Rufous Hummingbird	*Selasphorus rufus*	Present	Uncommon	Migratory
Belted Kingfisher	*Ceryle alcyon*	Present	Uncommon	Migratory
Lewis's Woodpecker	*Melanerpes lewis*	Probably Present	Rare	Breeder

Common Name	Scientific Name	Park Status	Abundance	Residency
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Present	Uncommon	Breeder
Red-naped Sapsucker	*Sphyrapicus nuchalis*	Present	Uncommon	Breeder
Downy Woodpecker	*Picoides pubescens*	Present	Uncommon	Breeder
Hairy Woodpecker	*Picoides villosus*	Present	Uncommon	Breeder
American Three-toed Woodpecker	*Pcioides dorsalis*	Probably Present	Uncommon	Breeder
Northern Flicker	*Colaptes auratus*	Present	Common	Breeder
Olive-sided Flycatcher	*Contopus cooperi*	Present	Uncommon	Breeder
Western Wood-Pewee	*Contopus sordidulus*	Present	Common	Breeder
Willow Flycatcher	*Empidonax traillii*	Probably Present	Uncommon	Breeder
Hammond's Flycatcher	*Empidonax hammondii*	Present	Uncommon	Breeder
Dusky Flycatcher	*Empidonax oberholseri*	Present	Common	Breeder
Cordilleran Flycatcher	*Empidonax occidentalis*	Present	Uncommon	Breeder
Say's Phoebe	*Sayornis saya*	Present	Uncommon	Breeder
Western Kingbird	*Tyrannus verticalis*	Present	Uncommon	Migratory
Loggerhead Shrike	*Lanius ludovicianus*	Present	Uncommon	Migratory
Northern Shrike	*Lanius excubitor*	Present	Uncommon	Migratory
Plumbeous Vireo	*Vireo plumbeus*	Present	Common	Breeder
Warbling Vireo	*Vireo gilvus*	Present	Common	Breeder
Gray Jay	*Perisoreus canadensis*	Present	Uncommon	Breeder
Steller's Jay	*Cyanocitta stelleri*	Present	Uncommon	Breeder
Blue Jay	*Cyanocitta cristata*	Present	Uncommon	Migratory
Clark's Nutcracker	*Nucifraga columbiana*	Present	Uncommon	Breeder
Black-billed Magpie	*Pica hudsonia*	Present	Common	Breeder
American Crow	*Corvus brachyrhynchos*	Present	Uncommon	Breeder
Common Raven	*Corvus corax*	Present	Common	Breeder
Horned Lark	*Eremophila alpestris*	Present	Uncommon	Migratory
Tree Swallow	*Tachycineta bicolor*	Present	Uncommon	Breeder
Violet-green Swallow	*Tachycineta thalassina*	Present	Common	Breeder
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Present	Uncommon	Migratory
Cliff Swallow	*Petrochelidon pyrrhonota*	Present	Uncommon	Migratory

Common Name	Scientific Name	Park Status	Abundance	Residency
Barn Swallow	*Hirundo rustica*	Present	Uncommon	Migratory
Black-capped Chickadee	*Poecile atricapillus*	Present	Uncommon	Breeder
Mountain Chickadee	*Poecile gambeli*	Present	Common	Breeder
Red-breasted Nuthatch	*Sitta canadensis*	Present	Uncommon	Breeder
White-breasted Nuthatch	*Sitta carolinensis*	Present	Uncommon	Breeder
Pygmy Nuthatch	*Sitta pygmaea*	Present	Common	Breeder
Brown Creeper	*Certhia americana*	Present	Uncommon	Breeder
Rock Wren	*Salpinctes obsoletus*	Present	Uncommon	Breeder
House Wren	*Troglodytes aedon*	Present	Uncommon	Breeder
American Dipper	*Cinclus mexicanus*	Present	Uncommon	Migratory
Golden-crowned Kinglet	*Regulus satrapa*	Present	Uncommon	Breeder
Ruby-crowned Kinglet	*Regulus calendula*	Present	Uncommon	Breeder
Western Bluebird	*Sialia mexicana*	Present	Uncommon	Breeder
Mountain Bluebird	*Sialia currucoides*	Present	Common	Breeder
Townsend's Solitaire	*Myadestes townsendi*	Present	Uncommon	Breeder
Veery	*Catharus fuscescens*	Present	Rare	Migratory
Swainson's Thrush	*Catharus ustulatus*	Present	Rare	Migratory
Hermit Thrush	*Catharus guttatus*	Present	Uncommon	Breeder
American Robin	*Turdus migratorius*	Present	Common	Breeder
Northern Mockingbird	*Mimus polyglottos*	Present	Uncommon	Migratory
Sage Thrasher	*Oreoscoptes montanus*	Probably Present	Rare	Migratory
European Starling	*Sturnus vulgaris*	Present	Uncommon	Breeder
American Pipit	*Anthus rubescens*	Probably Present	Rare	Migratory
Orange-crowned Warbler	*Vermivora celata*	Present	Uncommon	Breeder
Yellow Warbler	*Dendroica petechia*	Present	Uncommon	Breeder
Yellow-rumped Warbler	*Dendroica coronata*	Present	Common	Breeder
Townsend's Warbler	*Dendroica townsendi*	Probably Present	Uncommon	Migratory
MacGillivray's Warbler	*Oporornis tolmiei*	Probably Present	Uncommon	Breeder
Wilson's Warbler	*Wilsonia pusilla*	Present	Uncommon	Breeder
Western Tanager	*Piranga ludoviciana*	Present	Uncommon	Breeder

Common Name	Scientific Name	Park Status	Abundance	Residency
Green-tailed Towhee	*Pipilo chlorurus*	Present	Uncommon	Breeder
Spotted Towhee	*Pipilo maculatus*	Present	Uncommon	Breeder
American Tree Sparrow	*Spizella arborea*	Present	Uncommon	Migratory
Chipping Sparrow	*Spizella passerina*	Present	Common	Breeder
Brewer's Sparrow	*Spizella breweri*	Present	Uncommon	Migratory
Vesper Sparrow	*Pooecetes gramineus*	Present	Uncommon	Breeder
Lark Sparrow	*Chondestes grammacus*	Present	Uncommon	Breeder
Lark Bunting	*Calamospiza melanocorys*	Present	Rare	Migratory
Savannah Sparrow	*Passerculus sandwichensis*	Present	Uncommon	Breeder
Fox Sparrow	*Passerella iliaca*	Present	Rare	Migratory
Song Sparrow	*Melospiza melodia*	Present	Uncommon	Breeder
Lincoln's Sparrow	*Melospiza lincolnii*	Present	Uncommon	Breeder
White-crowned Sparrow	*Zonotrichia leucophrys*	Present	Uncommon	Migratory
Dark-eyed Junco	*Junco hyemalis*	Present	Common	Breeder
Black-headed Grosbeak	*Pheucticus melanocephalus*	Present	Uncommon	Breeder
Red-winged Blackbird	*Agelaius phoeniceus*	Present	Uncommon	Breeder
Western Meadowlark	*Sturnella neglecta*	Present	Common	Breeder
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Present	Uncommon	Migratory
Brewer's Blackbird	*Euphagus cyanocephalus*	Present	Uncommon	Breeder
Common Grackle	*Quiscalus quiscula*	Present	Uncommon	Breeder
Brown-headed Cowbird	*Molothrus ater*	Present	Uncommon	Breeder
Bullock's Oriole	*Icterus bullockii*	Present	Uncommon	Breeder
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	Probably Present	Rare	Migratory
Black Rosy-Finch	*Leucosticte atrata*	Probably Present	Rare	Migratory
Brown-capped Rosy-Finch	*Leucosticte australis*	Probably Present	Rare	Migratory
Pine Grosbeak	*Pinicola enucleator*	Probably Present	Uncommon	Migratory
Cassin's Finch	*Carpodacus cassinii*	Present	Uncommon	Breeder
House Finch	*Carpodacus mexicanus*	Probably Present	Uncommon	Breeder
Red Crossbill	*Loxia curvirostra*	Present	Uncommon	Breeder
Common Redpoll	*Carduelis flammea*	Present	Rare	Migratory

Common Name	Scientific Name	Park Status	Abundance	Residency
Pine Siskin	*Carduelis pinus*	Present	Uncommon	Breeder
Lesser Goldfinch	*Carduelis psaltria*	Probably Present	Uncommon	Migratory
American Goldfinch	*Carduelis tristis*	Present	Uncommon	Breeder
Evening Grosbeak	*Coccothraustes vespertinus*	Present	Uncommon	Breeder
House Sparrow	*Passer domesticus*	Probably Present	Uncommon	Breeder

Appendix D. Management recommendations for birds of Florissant Fossil Beds National Monument listed as "High Priority" for conservation needs by Colorado Partners in Flight.

Broad-tailed Hummingbird – This species is the most abundant hummingbird species in Colorado and breeds in ponderosa pine, mixed conifer, spruce-fir, and mid- to high-elevation riparian habitats. The most limiting requirement for this hummingbird is an abundance of flowering plants from which to gather nectar. As long as FLFO is not heavily grazed there should be plenty of natural nectar sources for Broad-tailed Hummingbirds.

Williamson's Sapsucker - This species will nest in a variety of habitats, but prefers mid-elevation coniferous forests. It appears that a healthy population of Williamson's Sapsuckers already exists in FLFO. However, periodic prescribed burning will attract insects that thrive in post-burn conditions which are an important food source for this species

Red-naped Sapsucker - This species prefers to nest in aspen over other high-elevation forested habitats. It is frequently encountered foraging in shrubby areas, especially willow carrs, during the breeding season. In order to encourage the growth of aspens at FLFO, some type of disturbance would need to occur. Either prescribed burning or selective thinning could accomplish this and promote the presence of this species.

Olive-sided Flycatcher – Olive-sided Flycatchers occur throughout the Rocky Mountain region, but are never abundant. This is another species that would most likely benefit from a periodic prescribed burn as they are often found foraging from snags at the edge of clearings.

Hammond's Flycatcher – Hammond's Flycatchers nest in coniferous and aspen forest in the southern Rocky Mountain region. This species prefers an open understory in which to forage, so it would be beneficial to this species to reduce or eliminate shrubs from some forested areas using some type of thinning practice.

Cordilleran Flycatcher – Cordilleran Flycatchers nest in forested areas where cliffs or rocky ledges are present and is often found in riparian areas with many vertical surfaces also. Little would need to be done to encourage the presence of this species at FLFO. As long as there are some cliffs with niches in which to place its nest it will occur.

Violet-green Swallow – Violet-green Swallow often nests on cliffs and sometimes near White-throated Swifts. It will also nest with Tree Swallows in aspen stands or in ponderosa pine snags. Managing for an abundance of ponderosa pine snags will provide nesting areas for this species.

American Dipper – American Dipper occurs along fast-flowing, rocky streams in the Rocky Mountains, where it relies wholly on aquatic insects (particularly larvae) that are sensitive to water quality. Making certain that the streams in FLFO stays free of

pollution, including runoff from roads, and clear of large amounts of silt will promote the presence of American Dippers.

Wilson's Warbler - Wilson's Warbler breeds in most frequently in high-elevation areas that are dominated by willow shrubs, including alpine tundra. FLFO is near the low-elevation limit for this species, so a dense breeding population of this species would not be expected. Encouraging thick stands of willow along streams, however, would most likely result in a few breeding pairs in the park. As this species is a very common migrant in the fall throughout Colorado, this species would certainly make us of a healthy willow population also.

Green-tailed Towhee – At lower elevations, Green-tailed Towhee nests in mesic areas with a high diversity of shrub species, including sagebrush and pinyon-juniper, and at higher elevations it uses more xeric shrub areas. This species is currently one of the more common breeders at FLFO. To keep the populations of Green-tailed Towhee at FLFO healthy, managers must keep an abundance and a diversity of various shrub species present in the park. A periodic prescribed burn may keep some areas open and stimulate growth of certain shrubs in the open areas.

Brewer's Sparrow - Brewer's Sparrow prefers sagebrush habitat but may also breed in areas dominated by mountain mahogany or other shrubs. This species would not be expected to be a common breeder in FLFO as it typically avoid heavily forested areas. Planting shrubs, specifically big sagebrush, would encourage this species to breed in the park, however.

Appendix E. Point count transects conducted in Florissant Fossil Beds National Monument and their locations, dates, and observer.

Point-count Numbers	Location	Date	Observer
1 - 20	East side of park	June 12, 2005	Walt Wilson
21 - 40	West side of park	June 1, 2005	Walt Wilson

Walt Wilson – Walt has worked as a seasonal biologist for RMBO for several seasons and is an excellent naturalist and a very valued member of our field staff. When Walt is not identifying birds, he is identifying grasses across the state and has found most of the species known to exist in Colorado. During the rest of the year, Walt is a teacher in the Colorado Springs school system.

Appendix F. Rocky Mountain Bird Observatory Point-Count Transect Protocol.

RMBO staff conducted point transects (Buckland et al. 1993) in order to sample bird populations in each habitat selected for monitoring. Each transect was surveyed by one observer following protocol established by Leukering et al. (2001). RMBO technicians conducted all transect surveys in the morning, between ½-hour before sunrise and 11 AM; most surveys were completed before 10 AM. To maximize efficiency, observers located the selected stand on the ground prior to the morning of the survey. For new transects, observers used this pre-survey visit to establish an access point for each stand, and a random distance and bearing from the access point (between 0-400 m) at which the first point count station would be located. On the morning of the survey, the observer began the point transect at the first count station and then continued along the pre-selected bearing for all remaining points if possible. In many cases, the pre-selected bearing eventually would lead the transect out of the target habitat, or to some obstruction (e.g., cliff or private land), forcing the observer to change the bearing of the transect. When this happened, the observer back-tracked to the last completed point count and randomly turned the transect right or left, at an angle perpendicular to the original bearing, and then alternated right or left if additional turns were necessary. In some small or linear stands (e.g., riparian sites), the size and shape of the stand determined the location and course of the transect.

Observers conducted up to 15 five-minute point counts at stations located at 250-m intervals along each point transect, recording all bird detections on standardized forms. Fly-overs (birds flying over, but not using the immediate surrounding landscape) were recorded, but excluded from analyses of density. For each bird detected, observers recorded the species, sex, how it was detected (e.g., call, song, drumming, etc.), and distance from the observation point. Whenever possible, they measured distances using Bushnell® Yardage Pro 500™ laser rangefinders. When it was not possible to measure the distance to a bird, staff used rangefinders to gauge distance estimates by measuring to some closer object. Observers treated the 250-m intervals between count stations as parts of a line transect, and recorded individuals of a short list of low-density species (all grouse, raptors, woodpeckers, and a few other rare or uncommon species) and measured the distance and bearing to each from where it was detected along the transect line. They also recorded bearings and distances to individuals of the same low-density species when they were detected at count stations. Birds initially detected on points that were again detected while moving between points were not included in the line-transect data. However, birds detected between points, but then again during the subsequent point count, were removed from the line-transect data, and included only on the point count.

A change in the bird data collection protocol from previous years was that since 2004, we treat all non-independent detections of individual birds as part of a 'cluster' together with the first independently observed bird, rather than as separate independent observations of those individuals. This means that if the detection of an individual bird is dependent upon the previous detection of another individual, the resulting observation is recorded as one independent detection with a cluster size of *C*, where *C* is the original individual detected plus the sum of any additional individuals whose detection was dependent upon

the first individual revealing its presence. For example, a bird sings, and is thus detected independently. The observer then looks over to that bird, and as a result, detects a second individual. The resulting observation is recorded as one detection of a cluster of two birds. This practice ensures that we adhere more strictly to the assumption inherent in random sampling that all observations are independent of each other.

Observers recorded atmospheric data (i.e., temperature in degrees Fahrenheit, cloud cover, precipitation, and wind--Beaufort scale) and the time at the start and end of each transect. They measured distances between count stations using hand-held Garmin® E-trex™ Global Positioning System units. All GPS data were logged in Universal Transverse Mercator (UTM) North American Datum 1927. At each count station, observers recorded UTM coordinates, whether or not the station was within 100m of a road, and vegetative data, including the structural stage and canopy closure of the forest, mean canopy height, the types and relative proportions of overstory trees, the sub-canopy volume and tree species composition, and the % coverage and types of shrubs within a 50 m radius of the point. Observers recorded these data prior to beginning each bird count.